NATIONAL MARINE FISHERIES SERVICE NORTHEAST SUPPLEMENT 04-105-08-01-NEC

DECEMBER 19, 2003

Science and Technology
Standards and Protocols for Surveys 04-105
NOAA Fisheries Protocols Hydro-dynamic Dredge Surveys: Surf Clams and Ocean Quahogs 04-105-08

REGIONAL OPERATING PROTOCOLS FOR STANDARD HYDRO-DYNAMIC DREDGE SURVEYS: SURF CLAMS AND OCEAN QUAHOGS

NOTICE: This publication is available at: http://www.nmfs.noaa.gov/directives/.

OPR: NEC **Certified by:** NEC (J. Boreman)
Type of Issuance: Renewal (01/06)

SUMMARY OF REVISIONS:

____

[Approving Authority name] Date
[Approving Authority title]

Appendix 1

Draft

December 19, 2003

Regional Operating Protocols For

Standard Hydro-dynamic Dredge Surveys:

Surf Clams and Ocean Quahogs

[1]Prepared by Personnel from NOAA Fisheries

Northeast Fisheries Science Center

---

[1] Ecosystems Surveys Branch: shared_files/Protocol Manual/Invert_Protocols/protocols_clam/Regional_protocols_clam_version2.0.doc

Table of Contents

Introduction

The Northeast Fisheries Science Center (NEFSC) conducts a triennial summer clam dredge survey in the Western Atlantic continental shelf region off the Eastern United States from North Carolina to Georges Bank, U.S.A. The regional strata sets are displayed in figures 1 and 2. The survey began in 1965 and has been conducted triennially since 1982 to monitor and assess abundance, population composition and recruitment of the Atlantic Surf Clam, *Spisula solidissima*, and the Ocean Quahog, *Arctica islandica*. Since 1970, the Fisheries Research Vessel (FRV) Delaware II has been the primary scientific platform conducting the clam survey. Prior to 1970, the FRV Albatross IV and the Commercial Vessel (CV), Undaunted, provided the scientific platforms for surveying the clam resources. Presently, this clam dredge survey is the only clam dredge survey conducted by NOAA Fisheries. Since the start of the survey, the NEFSC clam dredge survey has utilized an industry standard cage design dredge 4.6 meters (15') long with a 1.5 meter (5') wide cutting blade assembly. The dredge is rigged with an electrically powered submersible pump attached to a 16 nozzle manifold. The manifold is designed to excavate the substrate and clams forward of the cutting blade. The pump is supplied with 460 volts of electrical power from the Delaware II generators via a large sized mining cable. A large ramp is installed on the aft deck to facilitate deployment and retrieval of the dredge. Extreme safety precautions are enforced during the towing of the clam dredge. Because of the weight, position of equipment, and large power usage, the crew and scientific staff are allowed on the back deck until the dredge has been secured and the power to the pump has been terminated. The goal of the standard clam survey is to develop long-term fishery independent indices of relative abundance for several commercially important bivalve species and other by-catch fish and invertebrates to characterize their distribution. Additionally, specimens and other recorded data from the survey will be used to improve our understanding of biological conditions, temporal and spatial trends in population dynamics, identify community relationships and characterize habitat and catch relationships.

The following Regional Protocols have been designed to document established NEFSC survey standard protocols, act as a reference to ensure data quality and consistency, and to show adherence to the NOAA Fisheries Trawl Survey Protocols in terms of document format and general survey topics. Due to gear differences, some of the topics listed within this document may not apply to clam gear operations and will clearly be labeled as such.

Protocol 1: Deployment Warp and Towing Hauser Measurement Standardization

1.0 Deployment Warp and Towing Hauser Measurement Standardization

As stated in the NOAA Fisheries Clam protocols, the clam dredge survey deploys only one dredge rigged with a metal deployment warp (wire), a towing hauser (rope), and an electrical power cable. The metal deployment warp, hereafter referred to as the deployment wire, is used to safely set and retrieve the dredge from the bottom. It is only marked at the first 10 meter mark. This deployment wire is not used for setting the dredge at the true scope depth, it is only used to set the dredge on the bottom at the approximate scope depth. Towing of the clam dredge commences once tension is taken by the towing hauser and the deployment wire is slacked off. The flexible towing hauser rope, hereafter referred to as the hauser, is attached to the upper front portion of the dredge and is used to tow the dredge at the appropriate scope. The need for a flexible hauser is critical because of the strain and flexing placed on the rope during dredging.

The electrical power cable is attached by a strain relief device on the top of the dredge and is set at the same scope as the hauser.

With single dredge gear, there are no trawl doors or flexible panels to be concerned with. The clam dredge survey does not have the same issues as the trawl surveys. For trawl surveys having two warps, consistency in the measurements of warp length is important for maintaining consistency in trawl performance in two distinct ways. First, the length of the warp relative to the water depth (i.e. scope ratio) influences door spread and other aspects of trawl geometry. Second, the length of the warp on one side of the vessel relative to that on the other side influences the symmetry of the trawl and, depending on the degree of net skew, potentially influences trawl efficiency by affecting footrope contact with the bottom, head rope height, or fish herding. Dredge surveys have only the first issue to deal with in terms of effective bottom contact during the dredge haul. It is critical to have evenly spaced deployment markings on the towing hauser so that the appropriate amount of scope is set at the selected dredge haul depth. Again, the metal deployment wire is used to get close to the effective sampling scope, but is then slacked off and the tow is conducted using the flexible towing hauser.

Currently, during NOAA Fisheries clam dredge surveys, towing hauser length is determined by placing 25 meter marks at fixed increments along the back deck of the FRV Delware II prior to the dredge haul to achieve the correct scope. Methods of measurement have inherent problems that can lead to inaccurate scope values. For example, differential hauser length can result from inaccurate measurement and marking before a survey begins, differential hauser stretch and contraction of the marked hauser during a survey. Currently there is no redundant electronic measurement systems installed on the FRV Delaware II and used during the clam survey.

1.1 Deployment Warp (Clam Winch)

The responsibility of procurement, installation, and maintenance of the deployment warp resides with the NOAA Marine and Aviation Operations (NMAO), the division of NOAA currently responsible for the operation of fishery research vessels utilized to conduct NEFSC surveys. As of the 2002 clam survey, the deployment warp installed on the removable clam winch is a 7/8 inch 6x19 IWRC extra improved plow steel galvanized wire rope. It is not removed after every survey, but remains on the removable winch. See NEFSC Clam Operations Manual for specific installation and specification information for the clam winch. The deployment wire is marked at the leading 10 meter section with an inserted polypropylene line mark. NEFSC has not set any guidelines or tolerances on this mark or marking system, because it has no bearing on dredge consistency or efficiency. The Chief Bosun uses this as a guide when retrieving the dredge to indicate that the dredge is close to the vessel and trigger a verbal signal should be made to the Officer-On-Deck (OOD) to slow the vessel.

1.2 Deployment Warp Marking (Clam Winch)

As stated in section 1.1, the deployment wire is used to deploy and retrieve the cam dredge. A mark inserted at 10 meters is used as an indicator of proximity of the dredge to the bottom of the ship. NEFSC has not standardized this marking process and not set any tolerance on the accuracy of the mark.

1.3 Length Measurement of Deployment Warp

This section is not applicable to the standard clam survey. The NEFSC does not measure or record the deployment wire during operations.

1.4 Towing Hauser (Flexible Rope)

The responsibility of procurement, installation, and maintenance of the clam hauser resides with the Northeast Fisheries Science Center (NEFSC). The towing hauser installed on the starboard trawl winch is a 2 inch polypropylene rope, size #6, standard medium hard lay, type: blue fleck, with a tensile strength of 57, 000 lbs. It is removed from the starboard trawl winch after every survey. See NEFSC Clam Operations Manual for specific installation and specification information.

1.5 Towing Hauser Marking

The towing hauser used for clam dredging is marked by an independent wire contractor according to unambiguous marking guidelines provided to the contractor by the NEFSC. The specific marking guidelines can be found in the NEFSC Clam Operations Manual. But in general, One Ecosystems Surveys Branch staff member and one member of the NOAA Corp will present to witness the marking of the hauser. The hauser used for the clam survey shall be marked every 25 meters (82’) with a fiber weave. Physical marking of towing hauser involves spooling the hauser off the trawl winch onto a flat surface to measure the mark intervals relative to a standard measurement tool (metal wire of known length). In short, the current guidelines dictate that the clam dredge hauser is to be inspected (re-measured) and possibly re-marked before, during, and after every triennial survey. In other words, the inspection should take place before the first leg, after the first leg, after the second leg, and after the survey has been completed. If the markings are within tolerance, then no further action needs to be taken, especially after the survey is completed. If the hauser was inspected after the last survey, it can be reinstalled without a new inspection. The NEFSC has adopted a tolerance value of 1% allowable scope deviation at all marks as a decision rule during the inspection process on land. When measurement of the hauser occurs, a table of values will be generated, if a deviation at a certain position along the hauser is not within the 1% tolerance then a re-marking will commence from that position to the end of the hauser (eye). Currently, the Delaware II does not have the ability to completely re-measure the dredge hauser markings at sea, so it must be done at the dock. If the towing hauser is damaged at sea, the same marking process should be followed as stated in the Operations Manual.

1.6 Length Measurement of Towing Hauser

For the single hauser dredging system, one independently-calibrated measuring method shall be used. Due to the fact that only one hauser is deployed, there is no concern of a percent difference between corresponding hauser marks just cord length (25 meters) between successive marks for a single hauser. The NEFSC does not regularly charter the standard survey aboard commercial vessels, but if this occurs the NEFSC shall supply operational documentation concerning hauser requirements and marking specifications critical to the mission.

1.6.1 In-line wire meters

Although the starboard winch that contains the towing hauser is attached to the vessels Scientific Computer System (SCS) and is equipped with a metering system, the Chief Bosun must still observe the 25 meter (82’) marks in order to deploy the appropriate amount of deployment hauser. The hauser is spooled on top of the existing trawl warp on the winch. The Bosun will not get a real length of hauser value from the meters. A pre-determined table is used to set marks on the towing hauser at set locations on the back deck of the Delaware II to attain the appropriate scope of hauser. Independent verification of stretch is not done at sea during the survey. As stated above, the inspection process will resolve any stretch issue between legs of the survey.

1.6.2 Block wire counters

NEFSC currently does not use block meters to measure the towing hauser.

Protocol 2: Use of Auto-trawl Systems

2.0 Use of Auto-trawl Systems

The Delaware II, the Fisheries Research Vessel that is tasked with conducting the annual standard clam dredge survey, is not outfitted with an auto-trawl system of dredge deployment. This application is not critical for sea scallop dredge operations.

Protocol 3: Clam Survey Operational Procedures

3.0 Clam Survey Operational Procedures

For the Groundfish protocols, each Science Center was tasked with providing a written Operations Plan to their staff and the crew of the survey vessels that provide clear and unambiguous definitions and descriptions of all procedures required to properly conduct standard trawl sampling. This process will be followed for the standard clam dredge protocols, as well. The Regional Clam Protocols present the general clam protocols while the Operations Plan (Operations Manual) attempts to describe all protocols, gear, and materials in great detail.

Procedures for maintaining consistency in survey catchability of marine organisms include selection of tow location; speed during setting, towing, and retrieval of gear; determination of scope ratio; estimation and standardization of tow distance; tow direction; maximum sea state, and pump/electrical performance. Written unambiguous protocols specifying these and other issues that may affect survey consistency provide a mechanism for communication between scientific staff and the officers and crew of the fisheries research vessel maintaining continuity in procedures as personnel and vessels change over time.

The Regional and Operations Manual will be discussed by the Chief Scientist and the vessel crew at the start of each survey and again when crew changes occur.

There are several dredge haul guidelines that encompass the time period before a dredge haul is started, during the haul, and after the dredge haul is completed. A standard dredge haul conducted at sea can be defined as being 5 minutes in duration, with the correct scope, towing speed, and no gear damage encountered. However, it is outside the scope of this document to discuss all possible contingencies and threshold values related to conducting a dredge haul. Below is general topic headings outlined in the National Protocols for Clam Surveys. In depth details about how to deal with all non standard situations can be found in the NEFSC Operation Manual for Surf Clam and Ocean Quahogs.

The Regional Protocols include, but are not limited to the following issues and are not presented in time sequence or event order.

3.1 Scope

The wire-out (amount of hauser) for a clam dredge haul is based on the depth as read from a depth sounder. The standard ratio of length of hauser in meters to depth of water in meters is 2:1. This means there are 2 meters of hauser for every 1 meter of water depth. It is understood that some events may create a need to deviate from the specified value of scope. Should a deviation occur before the tow begins, the NOAA Officer-on-Deck (OOD) shall record in electronic comments the reason for the deviation in a specially designed bridge event log program on SCS. The OOD shall keep the scope value consistent throughout a tow unless there is an underwater hazard or other issue related to vessel safety. If the hauser is spooled off due to a hang during a dredge haul, the OOD and Chief Bosun have been instructed not to pull back the extended length. They are to indicate the amount of hauser taken and the time of the hang during the tow. The Watch Chief will make a decision as to whether to repeat the dredge haul or not. As long as the extended warp amount is less than 15 % of the total scope, it is not necessary to repeat the dredge. The NEFSC has developed electronic tools that alert the Watch Chief that a scope problem exists for a tow that was just completed. At that time the Watch Chief can decide to repeat a dredge haul with the correct scope value.

3.2 Speed of Dredge Haul

The OOD is responsible for acquiring and maintaining a constant dredge haul speed of 1.5 knots (over the bottom) from the time the slack is taken up on the towing hauser until the end of the five minute dredge haul. Speed variations between 1.3 and 1.7 are acceptable, but the target dredging speed of 1.5 knots should be adhered to as closely as possible. Monitoring the dredge speed during the haul will be accomplished in real time using differential GPS and manual adjustments to rpms. Multiple speed signals are recorded during the dredge haul by the Scientific Computer System (SCS) and a subset is supplied to a digital capturing system called FSCS (Fisheries Scientific Computer System). Variations in approaches to getting the vessel and gear up to 1.5 knots due to weather or current factors need to be inspected in more detail. The Clam Dredge Operations Manual describes in detail the methodology used to deploy the dredge and how to get the vessel to dredging speed. These are specific instructions of how to deploy the dredge and when to turn the power on to the pump.

3.3 Duration or Distance of a Dredge Haul

Dredge haul distance should not be used as a primary indicator of speed over ground distance versus time can provide a convenient double check. NEFSC survey standardizes speed which results in a standard distance covered. The designated 1.5-knot speed over ground equates to .2 nautical miles traveled during a 5-minute dredge haul. Distance traveled should only be used as a secondary check of primary speed indicators. Presently, the NEFSC does not deploy a realtime data collection device to determine bottom contact. But NEFSC does deploy an archiving bottom contact device, inclinometer, during most dredge hauls. The inclinometer device measures angle changes during the dredge haul. The data is offloaded using an optic shuttle after every dredge haul and archived on SCS. These data are post-processed and used to normalize tow distance based on contact of the cutting bar of the dredge to the sediment.

3.4 Direction of Dredge Haul

The dredge station locations are selected using a stratified random selection process. Stations are occupied according to the most efficient cruise track and not to any predetermined set of stations. Dredge haul direction shall be from the current station location towards the next available station location unless one of the following occurs:

- Towing to the next station location puts the dredge haul (approximately .5 NM), greater than one half the tow distance into an adjacent strata.
- Bad bottom, wrecks, cables or other underwater obstructions in the dredge path.
- Fixed gear in the dredge path and a clear dredge haul exists in another direction.
- Heavy traffic.
- Moderate to heavy seas in one direction, but still towable in another direction.

In any of these cases, an electronic note is made in the SCS clam event indicating the reason for the deviation.

3.5 Location (Determination) of Sampling Site

3.5.1 Location (Determination) of Sampling Site, specifically

The NEFSC clam survey employs a stratified, random sampling design that has remained constant through the survey time series that started in 1965. Survey strata are based on fixed depth ranges and regions of bathymetry along the

continental shelf of the survey area, ranging from Virginia to Georges Bank (Fig. 1 + 2). Strata coverage and the target number of stations to be sampled within each stratum are determined prior to conducting each survey.
All strata are subdivided into blocks 5 minutes of latitude by 10 minutes of longitude. These large blocks are further subdivided into 10 small blocks measuring 2.5 minutes of latitude by 2.0 minutes of longitude. The large blocks are defined as being the largest area that can be characterized by one tow.

Exceptions occur with very long, narrow strata, and strata with irregular borders. In these cases, the strata are subdivided directly into 2.5 X 2.0 minute blocks. These smaller blocks are then grouped into larger blocks so that the numbers of small ones are evenly distributed throughout the large ones. At least two large blocks are formed within each stratum. Each large block is composed of, as nearly as possible, 10 small ones. No large blocks are formed if there are an insufficient number of small blocks.

Stations selected within each stratum are determined using a Perl program called sta_selector. This program was written to generate a random selection of stations within each stratum. Each small block within a stratum is numbered sequentially. The number of small blocks contained within the stratum in which the numbers are being selected determines the range of random numbers. A random number selected then corresponds with a numbered small block. The center point of the selected small block will be the starting location of the tow. The numbering of tows is directly related to the order of random number selection (tow no. 1 is selected first and so on). A stratum number and the tow number within that stratum then identify stations. Once a small block is selected, all members of the corresponding large block are excluded from the selection population until there is at least one station selected in every large block within the stratum.

The sta_selector program creates several output files: a station data file (station_location.xls), nav.txt file, and a station.dat file. The Chief Scientist uses the station data file in Excel, in conjunction with charts, to create the cruise track by visually determining the most efficient or shortest distance between two stations. The nav.txt file is imported into a navigation software package (Navtrek), which is used by the bridge officers to set up the routes once the Chief Scientist has provided the sequential list of stations to occupy. An Arc-Info program employs the station.dat file to create 8" X 11" charts and the large bathymetric charts that have the station locations plotted.

Arc-info programs are employed to create strata lines and stations on digital rasterized copies of NOAA nautical charts. Rasterized renditions of the NOAA charts currently used are "Georges Bank and Nantucket Shoals" (No. 13200); "Approaches to New York, Nantucket Shoals to Five Fathom Bank" (No. 12300); "Cape May to Cape Hatteras" (No. 12200); and, "Cape Hatteras to Charleston" (No. 11520). The bridge officers continue to navigate by using the official NOAA charts.

Geographic positions, loran lines-of-position, and charts are saved internally at the NEFSC upon completion of a cruise and made available to stakeholders.

3.5.2 Non Suitable Sites - Procedures to Resolve Once Arrive on Location

Fisheries Research Vessel O.O.D.'s must attempt to comply with several dredging guidelines when preparing to conduct or conducting the NEFSC standard clam dredge hauls some of which are detailed in sections 3.1 – 3.4. Some of these dredging guidelines are addressed prior to conducting the dredge haul and others are addressed during or after the dredge haul is completed. Either way, the purpose of the guidelines is to facilitate the completion of a standard dredge haul. Below is a discussion about the guidelines and what to do if the guidelines are not met. These guidelines should be thought of as what the OOD is thinking about as they approach a possible dredge location and how a successful dredge haul is conducted.

a. Never change hauser length (scope) after the dredge haul starts (hauser winch locked), set scope length as described in section 3.1
b. Speed is 1.5 knots during the haul
c. Dredge hauls shall be 5 minutes in duration
d. Dredge haul shall start at the marked location and be towed in a direction towards the next station
e. Stay within stratum boundaries
f. Relocation of the station location is limited to .5 nautical mile radius from original station location without permission from Chief Scientist
g. Never tow in less than 30 feet/9 meters/5 fathoms
h. Never tow in greater than 360 feet/120 meters/60 fathoms because of pump seals
i. Search time for good bottom is limited to a half hour as well as .5 nm

j. Never shut off power to pump during dredge haul, unless ending haul due to other issue

These guidelines describe the reasoning and thought process the OOD must apply to the decision making process (tactics) when planning for, setting up for, and conducting a clam dredge haul. These guidelines are discussed in greater detail in the NEFSC Clam Operations Manual.

Whenever possible the default number of station locations per stratum should be occupied year to year. The next section that talks about how to qualify and possibly repeating a tow, will affect the decision to maintain that default number of dredge hauls per stratum. The amount of time searching for bottom, avoiding traffic and gear, and repeating bad dredge hauls will affect the overall success of the survey and may limit the survey coverage. For this reason, it is not critical to get all station locations for each stratum, it is more important to conduct tows in all strata.

The underlying role of the OOD is to occupy the safest and most timely cruise track considering all other factors; weather, traffic, fixed gear, underwater hazards, etc. Each station location is reviewed prior to arrival by the Chief Scientist, Operations Officer, and the Commanding Officer. The station locations are plotted on nautical charts and reviewed for chart identified restrictions. Some movement of station location (starting position and direction) is completed before arrival if underwater hazards can be identified (cables, wrecks, etc). In this case, the Chief Scientist can supply a randomly chosen location within the .5 nautical mile radius to start the dredge haul. When the station locations look reasonable on the charts, but there is an issue once the FRV reaches the station location, this is where these guidelines are helpful. Whenever possible the direction of the dredge haul should be altered before moving the actual station location.

Marginal to Un-towable Bottom

The OOD has the clearance to pre-run (scout) the bottom topography and decide if it is safe to deploy the gear. If they decide not to tow at a specific site, then they can randomly choose a new station location within .5 nautical miles of the original station location and record the reason in the station comments without consulting the Chief Scientist. Un-officially the time limit for searching for good bottom is about a half hour before moving on to a totally new site. The Chief Scientist shall be consulted for this decision and will provide a newly selected random site.

Traffic

The OOD has the clearance to modify the starting position and possibly the direction of the dredge haul to adjust for traffic in and around a station location. Again, within the .5 nautical mile radius, the Chief Scientist does not need to be consulted.

Fixed Gear

The OOD has the clearance to modify the starting position and possibly the direction of the station location to adjust for fixed gear in and around a station location. Again, within the .5 nautical mile radius, the Chief Scientist does not need to be consulted.

Sea State (current, wind, waves)

Dredge haul direction (or the ability to dredge haul at all) may be determined by sea state. If the conditions are as severe as to pose a safety issue or data quality issue operations may be affected. Safety related decisions shall be made by the vessel Commander, while data quality decisions shall be made by the Chief Scientist.

Tow direction relative to prevailing current has historically been treated as a random variable. Conscious efforts to tow into the current or avoid cross currents will impart an undesirable bias to the data, which is to be avoided.

Wind direction is generally not a factor for dredging operations. Sustained high winds with a long fetch often cause the waves and swells to come from the same direction. In this case, the direction of dredge haul may have to be based on the seas. In open waters, canceling of operations happens when sustained winds of 35 knots are observed because this speed usually corresponds to sea states that are excessive for safe work on deck and proper gear performance.

3.6 Determining the Success of a Tow, Procedures if Unsuccessful

3.6.1 Determining a Successful Dredge Haul

There are two phases of determining if a dredge haul was successful. Some of the guidelines outlined in section 3.5 should have been met in order to conduct the dredge haul and then the rest during the dredge haul. The guidelines described above along with performance during the tow will dictate the success of the second phase. Each dredge haul will be coded with a qualitative three digit numeric value (Station-Haul-Gear [SHG]) value indicating the severity of gear damage, dredge haul time increase or decrease, gear damage, and fixed gear interception. See the NEFSC Clam Operations Manual for specific coding details. The most important result of these coding details is to facilitate the ability to occupy and conduct the default number of standardized biologically represented dredge hauls. As explained in the introduction, as standard dredge haul is one that is 5 minutes in duration, set with the appropriate amount (scope) of hauser, and experiences no gear damage or loss of power to the pump. There are codes to indicate problems during dredge hauls that give the auditors and users of the data a method of separating possible non-standard tows.

3.6.2 Procedures for Repeating Unsuccessful or Aborted Dredge Hauls

Occasionally it is necessary to repeat a dredge haul because of malfunction or damage to the dredge. In cases of severe malfunction, severe damage, loss of power during the dredge haul, no initialization of sensor package, the tow will not be counted as a standard dredge haul and must be repeated. It may be sampled for biological data which is independent of abundance and biomass information. For recording purposes, the tow is assigned a valid station number, but the coding for

Station-Haul-Gear (SHG) value shall be greater than 1-3-6, indicating a non-valid catch for assessment purposes.

In some cases, it may be difficult to determine how to properly code a dredge haul that has encountered problems. The following guidelines should be used:

- It is essential to indicate a minimum of 2 for haul value, which flags data auditors that something abnormal occurred during the tow.
- If in doubt, about SHG coding consult with the Chief Scientist
- Ensure that the catch is worked up at least to the point of lengths
- An accurate and complete account of what occurred to the gear must be given in the FSCS Station Initialize Watch Chief comments field; the lead fisherman or boatswain must be interviewed to determine details on gear condition.
- When significant gear damage occurs, the Chief Scientist or Watch Chief should be informed, and the decision to re-tow must be made based on the severity of the damage.

The decision to repeat a tow is made by the Chief Scientist and is based on a coded SHG value greater than 1-3-6. The following factors may override this decision:

- The probability of the same or greater damage to the dredge occurring; in this case, the station location should be moved .5 nm from original site or to a randomly chosen new site

- The current progress of the cruise as a whole (when time remaining in the cruise threatens the completion of the entire survey area)
- The status of shipboard gear inventory, i.e. how many undamaged dredge components are left (blade assemblies, blades, etc.)

The following factors must be weighed with every decision to override a retow:

- The overall progress of the cruise (does time in the context of the entire survey permit extended effort on any one station)
- The phase of the cruise (a subset of above) i.e. risking the last undamaged dredge component on the last day of leg I may not be a serious risk for the cruise at all, as the ship will return to port and can replenish the supply of dredge components without much loss of operational time
- The number of stations completed in the stratum in question (higher priority would be placed on a station that represents the sole tow in the stratum, lower priority would be placed on a station that would represent the 8th successful tow in the stratum)
- The current relative importance of the stratum in question (is it a critical stratum for certain assessment species)
- The geographic coverage within stratum that the tow represents

3.7 Vessel and Winch Operation during Dredge Deployment and Retrieval

To ensure comparability between dredge hauls and years of standard surveys, vessel operators will be asked to follow standard procedures when setting, towing, and retrieving the dredge gear. Detailed procedures are available in the NEFSC Clam Operations Protocols and in a sub-document called "Bridge Clam Operations". If the OOD has satisfied all of the pre-dredge haul guidelines, they can then conduct a standard clam dredge haul. The general goals that are set out as the basic protocols are as follows:

3.7.1 General Guidelines for Setting the Clam Dredge

Once the OOD has the vessel in the correct position to set the dredge they will communicate a scope value and give permission to the winch operator to set the dredge. The OOD will bring the vessel up to a standard setting speed (5 knots) and prepare for deployment and speed adjustment. The Chief Bosun will deploy the dredge using the clam winch and deployment wire. Prior to setting the dredge the appropriate scope amount of towing hauser is streamed behind the vessel. The OOD would have already determined from a table of values the position of a mark on the back deck to achieve the required scope of towing hauser. Just prior to landing on the bottom the power is turned on to the pump. When the ship starts to tighten up on the towing hauser the Chief Bosun slacks off on the deployment warp. The standard tow is started when the Bosun determines that the dredge is "On the Hauser", meaning that the load is now on the towing hauser. The primary goal during this phase is to achieve a good set on the bottom.

3.7.2 General Guidelines for Towing the Clam Dredge

Once the trawl winch with the towing hauser has been set, the "standard tow" begins. The vessel should be at 1.5 knots and the timer should be engaged for a 5 minute dredge haul. During the tow the Chief Bosun should be aware of any changes in hauser length due to hangs. The primary goal during towing is to maintain a constant speed and straight course whenever possible.

3.7.3 General Guidelines for Retrieval of Clam Dredge

When the tow timer sounds off, the Chief Bosun starts to retrieve the scallop dredge. This is the end of the standard tow. The vessel maintains speed during retrieval, except when the last 10 meters is seen on the deployment wire. As soon as the Bosun sees the last 10 meters (32.8') mark on the deployment warp the power is turned off to the pump. When the dredge comes close to the surface the Chief Bosun will inform the bridge to slow down. The dredge is slowly brought onboard using the dredge positioning door and dragged up the dredge ramp assembly, secured, and dumped onto the sorting table. The primary goal when retrieving is safety of the crew and scientists.

3.8 Defining Responsibility for Decisions Regarding Operational Protocols

All aspects of the clam survey operation will be overseen by the Chief Scientist. Final decisions regarding station locations and station scheduling are the responsibility of the Chief Scientist. Vessel operation including safety, dredge gear deployment and retrieval, and all matters to vessel safety will be the responsibility of the Fisheries Research Vessel Commanding Officer. Day to day operations per 6 hour watch is the responsibility of the assigned Watch Chief.

Training in Fisheries Scientific Computer System (FSCS) and standard sampling of the dredge hauls is the responsibility of the Chief Scientist and Watch Chiefs.

It is the responsibility of both the Chief Scientist and the Commanding Officer to keep lines of communication open between crew and scientists, not only for safety purposes, but to ensure that all standard operations are proceeding in the manner outlined here.

See the NEFSC Clam Operations Manual for detailed descriptions of "prior to sailing", "during operations" and "after a cruise" instructions for Chief Scientist, Watch Chief, and FSCS administrator.

Protocol 4: Clam Dredge Construction, Repair, Inspections

4.0 Clam Dredge Construction, Repair, Inspections

4.1 Clam Dredge Construction and Repair

The NEFSC clam survey utilizes an industry standard 1.5 meter (5') wide clam dredge, 4.6 meter (15') long cage style hydro-dynamic dredge rigged with a electrically powered submersible pump and manifold. The manifold excavates the sediment and clams forward of the depressed blade assembly. The 5 cm (2") liner is placed inside the cage to capture small clams and quahogs.

Construction plans for the standard clam dredge are included as figures 3 - 7. The plans include engineering drawings of the dredge. In addition, each plan contains a description of all materials used, and the qualities of these materials considered important for proper dredge function.

A checklist shall to be developed specifying the dimensions, and their tolerances, or other design features considered important for proper dredge function. The checklist will be used to verify that each newly constructed or repaired dredge components are within operational tolerances before use. Members of the scientific staff of the NEFSC, who are trained in dredge construction and repair verification, will verify that the dredge and components are within operational tolerances.

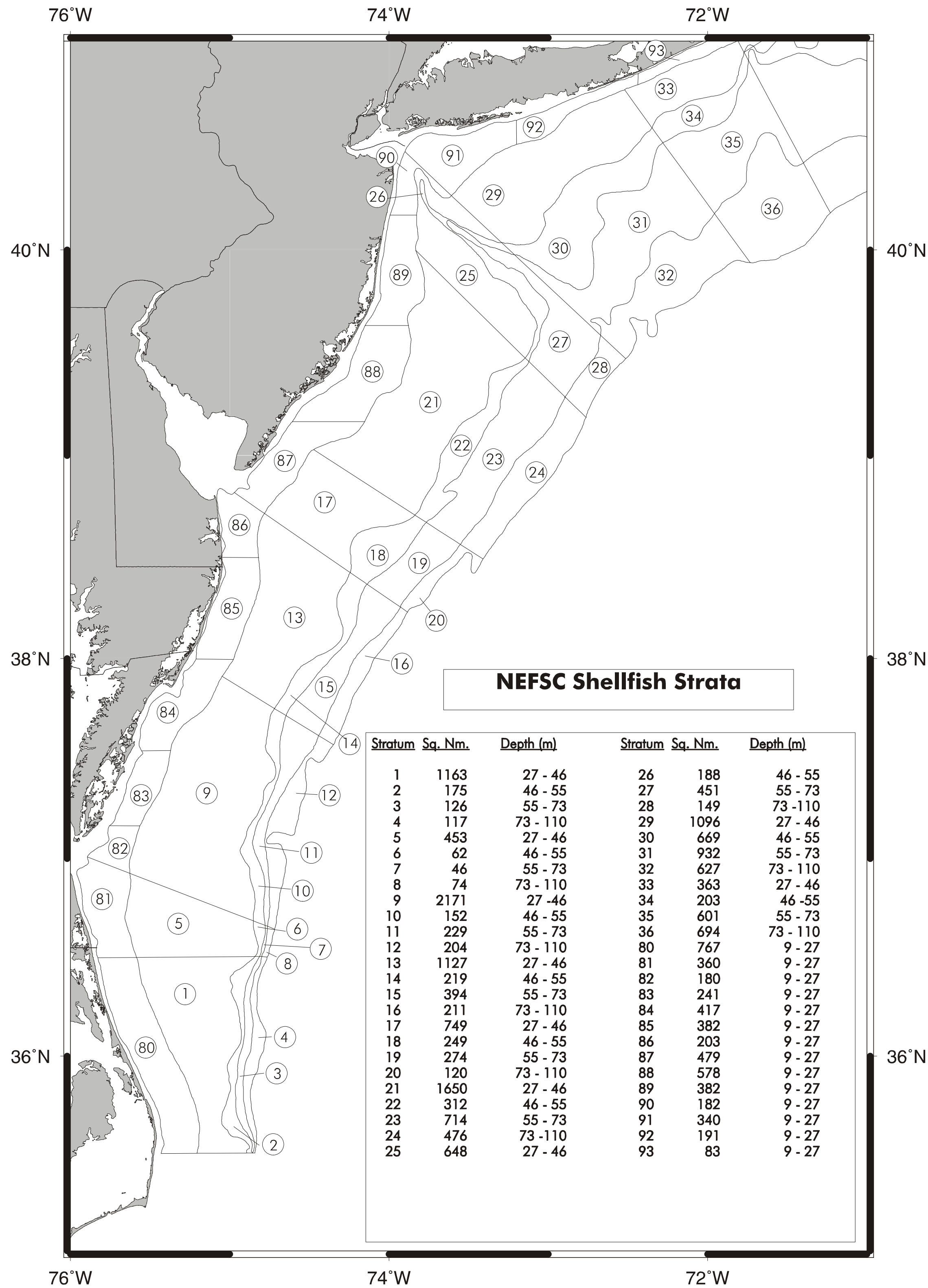
4.2 Clam Dredge Repair at Sea

Repairs to dredges at sea should follow the same construction plans and procedures mentioned in section 4.1.

4.3 Clam Dredge Gear Inspections/Certification

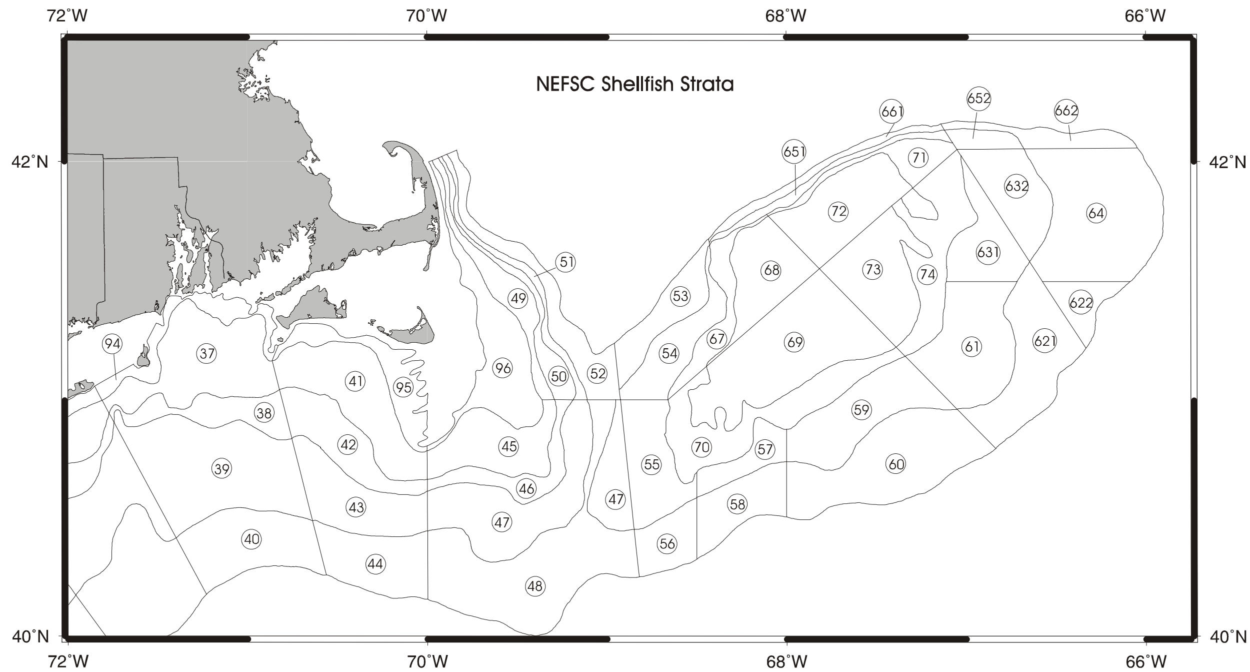
Presently, clam gear inspections and certifications protocols are being developed. Specific guidelines and recording forms for gear inspections will be created in the near future.

Figure 1. Southern Shellfish Strata Set



Stratum	Sq. Nm.	Depth (m)	Stratum	Sq. Nm.	Depth (m)
1	1163	27 - 46	26	188	46 - 55
2	175	46 - 55	27	451	55 - 73
3	126	55 - 73	28	149	73 -110
4	117	73 - 110	29	1096	27 - 46
5	453	27 - 46	30	669	46 - 55
6	62	46 - 55	31	932	55 - 73
7	46	55 - 73	32	627	73 - 110
8	74	73 - 110	33	363	27 - 46
9	2171	27 -46	34	203	46 -55
10	152	46 - 55	35	601	55 - 73
11	229	55 - 73	36	694	73 - 110
12	204	73 - 110	80	767	9 - 27
13	1127	27 - 46	81	360	9 - 27
14	219	46 - 55	82	180	9 - 27
15	394	55 - 73	83	241	9 - 27
16	211	73 - 110	84	417	9 - 27
17	749	27 - 46	85	382	9 - 27
18	249	46 - 55	86	203	9 - 27
19	274	55 - 73	87	479	9 - 27
20	120	73 - 110	88	578	9 - 27
21	1650	27 - 46	89	382	9 - 27
22	312	46 - 55	90	182	9 - 27
23	714	55 - 73	91	340	9 - 27
24	476	73 -110	92	191	9 - 27
25	648	27 - 46	93	83	9 - 27

Figure 2. Northern Shellfish Strata Set



Stratum	Sq. Nm.	Depth (m)	Stratum	Sq. Nm.	Depth (m)	Stratum	Sq. Nm.	Depth (m)
37	672	27 - 46	52	307	73 - 110	651	115	55 - 73
38	280	46 - 55	53	268	73 - 110	652	60	55 - 73
39	967	55 - 73	54	278	55 - 73	661	122	73 - 110
40	513	73 - 110	55	364	55 - 73	662	173	73 - 110
41	602	27 - 46	56	209	73 - 110	67	210	46 - 55
42	343	46 - 55	57	184	55 -73	68	370	0 -46
43	432	55 - 73	58	300	73 - 110	69	938	0 -46
44	383	73 -110	59	538	55 - 73	70	520	46 - 55
45	392	27 - 46	60	816	73 - 110	71	146	46 - 55
46	416	46 - 55	61	576	55 - 73	72	504	0 -46
47	871	55 - 73	621	551	73 - 110	73	501	0 - 46
48	1109	73 - 110	622	150	73 - 110	74	433	46 - 55
49	244	27 - 46	631	345	55 - 73	94	229	9 - 27
50	150	46 - 55	632	368	55 - 73	95	446	9 - 27
51	139	55 - 73	64	988	73 - 110	96	495	9 - 27

Specifications for Construction of NEFSC Clam Dredge

Figure 3. **Standard Clam Dredge (Frame Top, Port, and Front)**

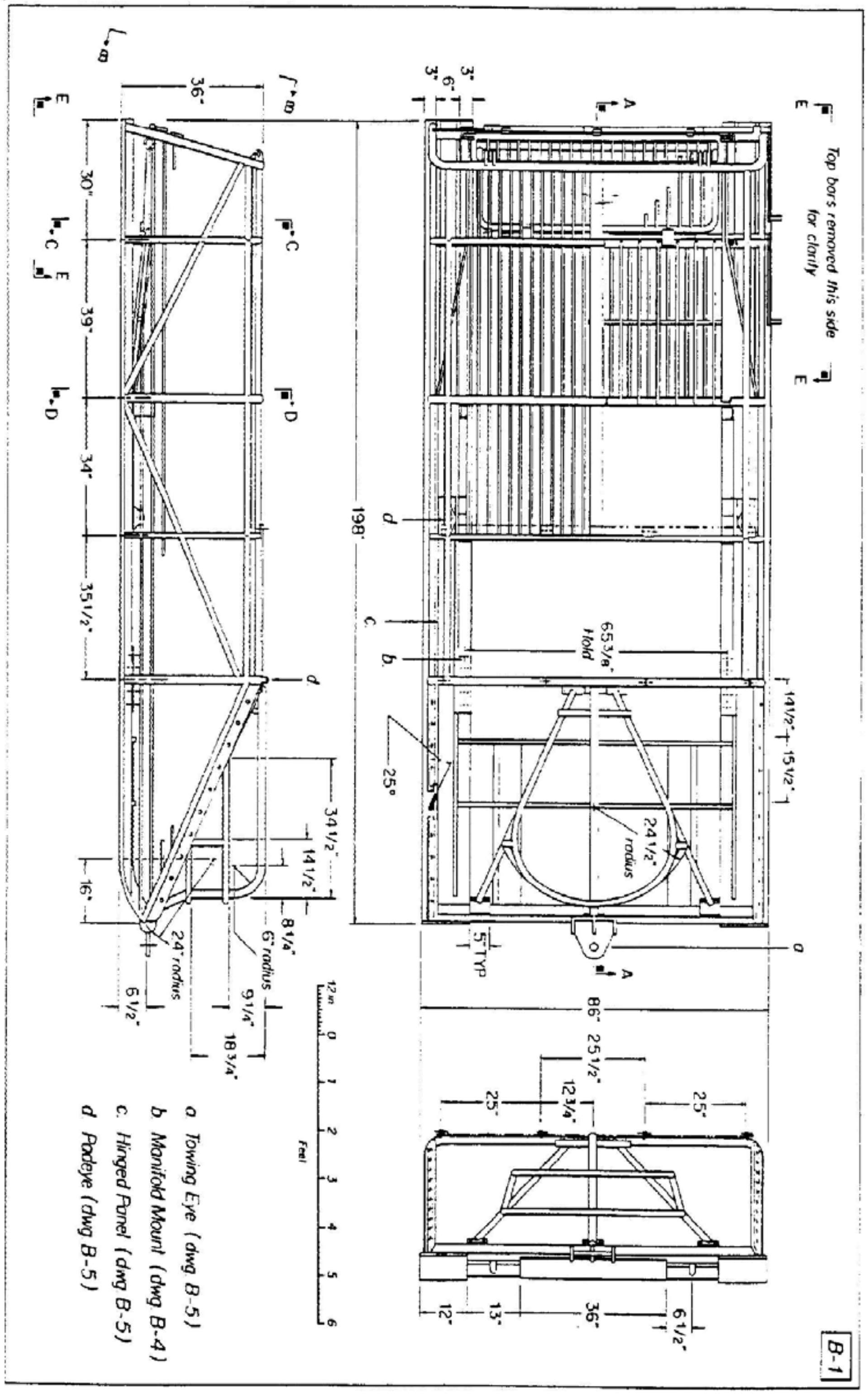


Figure 4. Standard Clam Dredge (Frame Starboard and Rear)

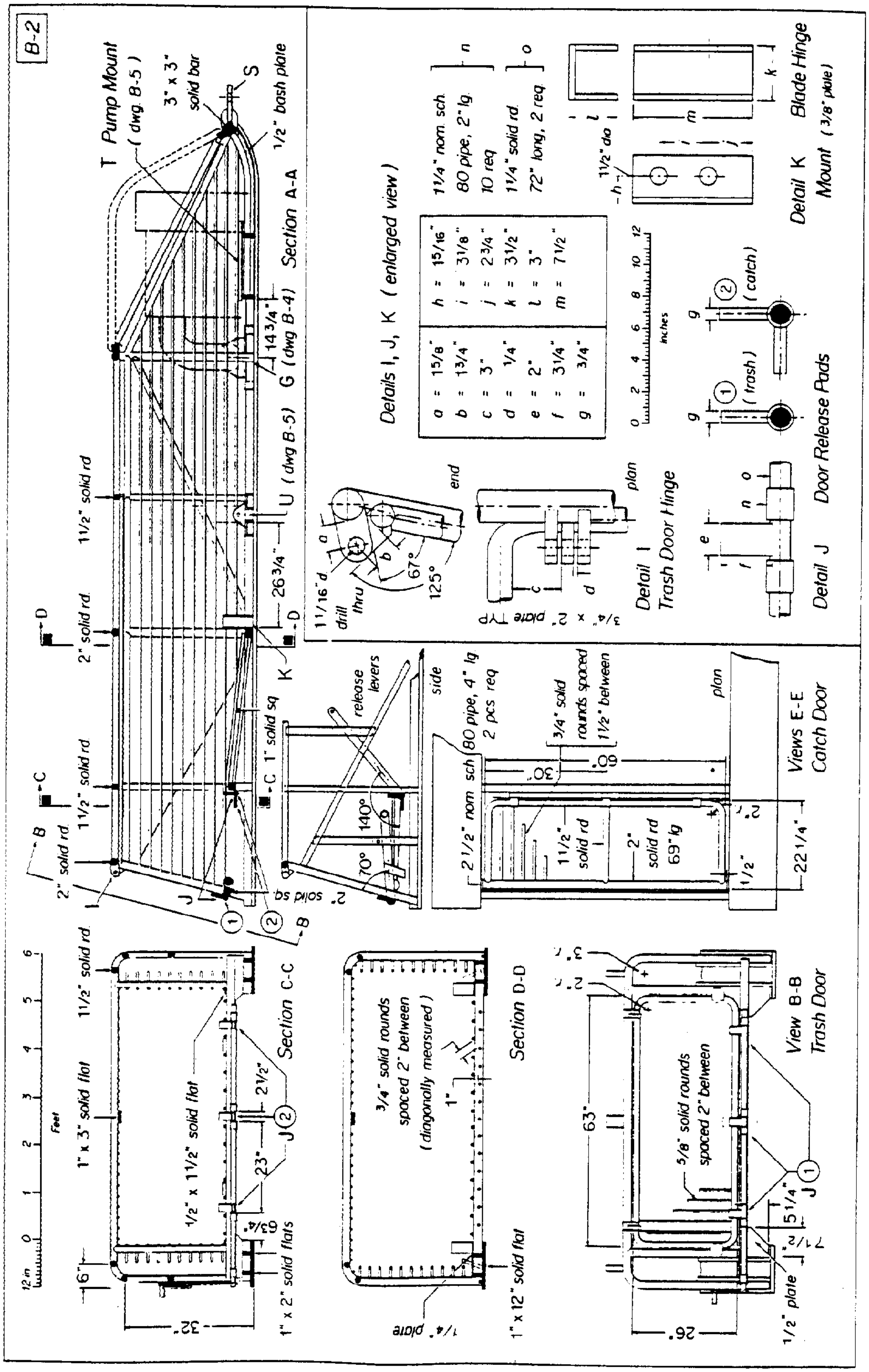


Figure 5. Standard Clam Dredge (Blade Assembly)

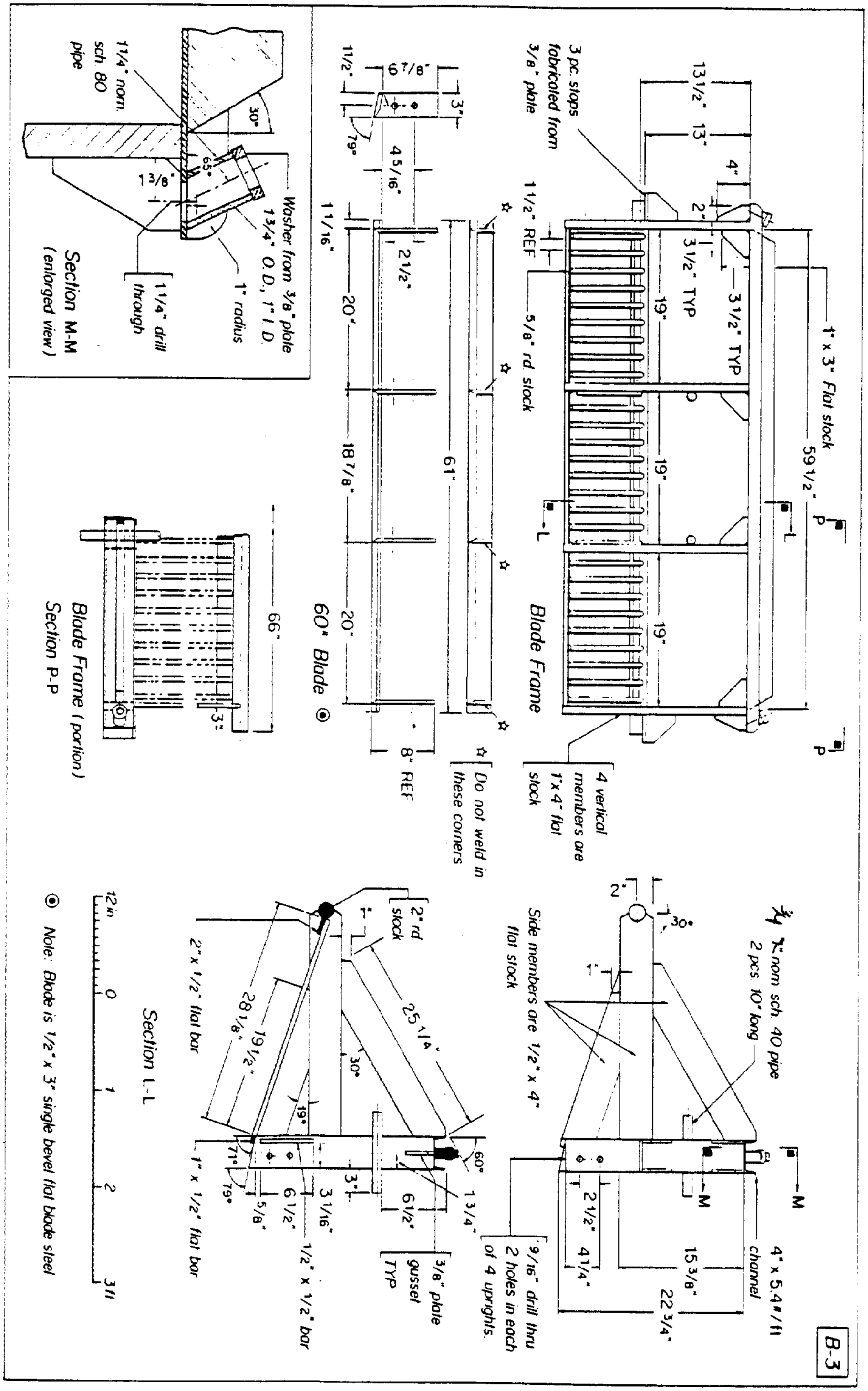


Figure 6. Standard Clam Dredge (Manifold Assembly)

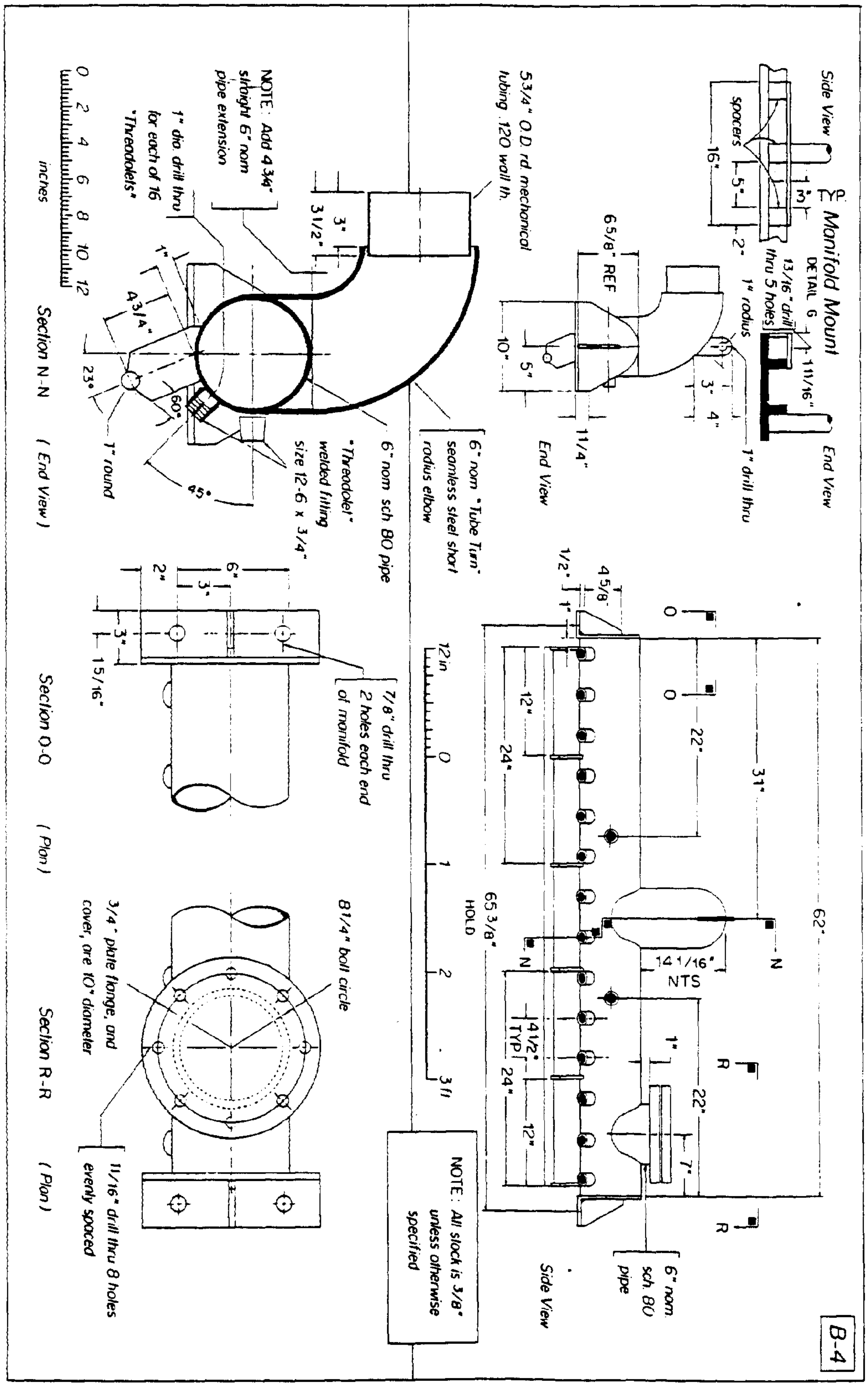


Figure 7. Standard Clam Dredge (Pump Mount Bracket)